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**(19) (CA) APPLICATION FOR CANADIAN PATENT (12)**

**(54) Metering Device for Dispensing a Bulk Material**

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**(30) (CH) 3593/90 1990/11/13**

**(57) 12 Claims**

Notice: The specification contained herein as filed

**Canada**

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ABSTRACT OF THE DISCLOSURE

A metering device for dispensing a bulk material includes a removable unit with a bulk material container and a dispensing device, a drive for driving the dispensing device, a balance, and an electronic control device, where the drive, the balance and the electronic control device are not separated from the metering device upon removal of the removable unit. The electronic control device maintains an adjustable delivery rate, constant over a period of time, whereby the removal rate of contents of the container is measured by the balance located in a base housing and supplied to the electronic control circuit. The removable unit is replaceable with another similarly constructed removable bulk material container and dispensing device, if desired, to obviate the cost of cleaning the removable unit between uses with different bulk materials.

METERING DEVICE FOR DISPENSING A BULK MATERIAL

BACKGROUND OF THE INVENTION

5        Metering devices are known for metered dispensing of a bulk material, for example an ink powder, said devices having a bulk material container, a dispensing device with the corresponding drive, and a balance, as well as an electronic circuit controllable by the balance and an input device, said circuit serving as a control device to keep an adjustable delivery rate constant over a  
10      specified or unspecified time, or to ensure dispensing of equal portions, or any possible combination between the delivery rate and individual or total dispensing.

15      Metering devices of this kind have served very well in the many locations where they are used. Because of the strict requirements for the precision with which they operate, such devices are very expensive. This in turn means that a special device cannot be acquired for each product which must be metered during a certain time, but the existing devices must be used for a wide variety  
20      of products. However this is only possible if the devices are cleaned with the greatest care after each use. Depending on the nature of the products to be metered, the cleaning expense can be very high, so that the question often arises as to whether, despite the high cost, acquisition of one or even several additional devices must be  
25      considered.

SUMMARY OF THE INVENTION

30      The present invention constitutes the solution to this problem. Specifically it relates to a metering device of the species recited at the outset, characterized by the fact that the bulk material container and the dispensing device constitute a structural unit assembled in such fashion that they are removable as a unit from the other parts which cannot be separated from one another.  
35      Thus it is possible to acquire a structural unit composed of a bulk material container and a dispensing device for any bulk material to be dispensed, whereby said unit can be used as a supply container for storing the bulk

material in question or can be placed on the base element - the expensive part of the metering device - for metered dispensing of bulk material, said base element consisting of at least the balance, the electronic control, and the drive for the dispensing device. A structural unit of this kind, which, depending on the application, can also be provided with a mixer for mixing the bulk material present in the bulk material container, need not be emptied and cleaned after removal from the base element, but, depending on the application, can serve with or without a cover as a storage container for the bulk material in question, in other words for example for a black ink or for a white ink. If the container is emptied however, it does not have to be specially cleaned if it is to be re-used later for the same bulk material. An especially simple design is achieved by virtue of the fact that a screw conveyor is used as a dispensing device, in other words a device with a feed screw rotatably mounted in a nonrotatably mounted tube provided with a filling opening, with the bulk material container being permanently attached to the tube or a housing surrounding the tube and terminating in its filling opening.

A device for dispensing bulk material is already known which is composed of four assemblable parts and can be disassembled into these four parts: these are a base, a drive motor, a dispensing unit, and a funnel, with different dispensing units, namely a vibrator, a screw conveyor with one screw, and a screw conveyor with a double screw are optionally available. An important feature of this known device is the interchangeability of the dispensing unit which is mounted between the drive and the supply container. This known design achieves the goal of providing a universally applicable dispensing device with rather modest dispensing precision, in which the interchangeable parts, if they are not needed, take up relatively little room. The funnel cannot be used as a supply container firstly because it is open at the bottom and is so designed that it can be mounted on different

dispensing units, and secondly because, for precisely this reason, it is available only as a single unit.

On the other hand, the present invention serves to solve a problem which is of primary importance in precision equipment, namely the possibility, without costly cleaning processes, of using the parts that are expensive in themselves, namely the precision balance and the control devices, for dispensing a wide variety of similar materials, in such a way that they do not have to be poured for processing in the device.

BRIEF DESCRIPTION OF THE DRAWINGS

One embodiment of the invention will now be described with reference to the attached figures wherein:

Figure 1 is a perspective view of a metering device according to the invention;

Figure 2 is a perspective view of the bulk material container assembled to the dispensing device;

Figure 3 is a side view of the entire device;

Figure 4 is a view of the back of the entire device;

Figure 5 is a side view of the device without the container and dispensing device;

Figure 6 is a view of the back of the device without the container and dispensing device;

Figure 7 is a view of the back of the bulk material container assembled to the dispensing device;

Figure 8 is a side view of the housing of the dispensing device;

Figure 9 is a front view of the housing of the dispensing device, viewed in the direction of arrow IX in Figure 8;

Figure 10 is a section along line X-X in Figure 8, but with the screw conveyor in place;

Figure 11 is a vertical section along line XI-XI of Figure 12; and

Figure 12 is a top view of the baseplate of the device.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

5 A metering device shown in the drawing comprises a balance with a load-carrying balance pan 1. The pan 1 forms a lid of container 2 permanently connected with it, in which container, components that respond to a load as well as an entire electronic control device are located, as shown and described in EP-B1 035 579, the disclosure of which is herein incorporated by reference. A digital display and an entry keypad which are usual in such balances can be located in a window in a housing or in a 10 control and display housing connected to container 2 by a cable.

15 A baseplate 3 of the device rests on balance pan 1, baseplate 3 being permanently connected therewith by screws 4. A motor mounting plate 5 is permanently screwed to baseplate 3, with two motors 8 and 9, each equipped with a step-down transmission 6 and 7, respectively, being fastened to plate 5. Motor 8 is a mixer motor and motor 9 is a screw drive motor. Drive 6 has a fourth gear 10 on a 20 drive shaft 6a and drive 7 has a first gear 11 on a drive shaft 7a.

25 A large funnel 12 serves as a bulk material container, a lower end of funnel 12 being provided with a dispensing device. Here the dispensing device is a screw conveyor mounted in a screw housing 13 with a horizontal-axis feed screw 14 and a tube 15 mounted nonrotatably and surrounding screw 14 at least partially, as shown and described in detail in Switzerland Patent Application No. 30 2995/90-2 filed September 14, 1990, the disclosure of which is herein incorporated by reference.

35 In a lower area of the bulk material container, in other words in a vicinity of a discharge opening which terminates in a feed opening 13a of screw housing 13, a mixer is incorporated with two horizontal-axis mixers mounted in a mixer plate 20 to stir a bulk material contained in the bulk material container, the shafts of the mixers being designated 16 and 17. A fifth gear 18 is mounted externally on shaft 16 and third gear 19 is

5 mounted externally on shaft 17, such that fifth gear 18 and third gear 19 mesh with one another. As shown in Figure 4, third gear 19 also meshes with fourth gear 10 which is mounted on the output shaft 6a of drive 6 which is connected to mixer motor 8 and is driven thereby, so that the two shafts 16 and 17 of the mixer are driven in opposite directions by mixer motor 8.

10 On a free end of screw 14 is a second gear 21 which meshes with a first gear 11 which is mounted on the output shaft 7a of transmission 7 connected to drive motor 9 and driven thereby, so that the output device is actuated by drive motor 6. One essentially novel and inventive aspect of the device shown in the drawing is that the funnel-shaped bulk material container 12, together with screw housing 13 in which the screw conveyor which serves 15 as a dispensing device is located, forms one assembled unit, which, as a whole, as shown in Figure 7, is removable from remaining, unseparated parts shown in Figure 6. For this purpose, as shown in Figures 8 and 9, an underside of screw housing 13 is provided with two sliding 20 shoes 22 and 23 whose projecting noses 22a and 23a fit into recesses 3c and 3d respectively of baseplate 3, and recesses 3c and 3d are overlapped by ribs 3a and 3b respectively, so that the unit, shown assembled in Figure 25 7, can be placed on baseplate 3 and positioned by axially parallel displacement in a direction of arrow A shown in Figures 2, 3 and 12, in other words in a direction parallel to axes of drives 6 and 7 as well as their output shafts 6a and 7a, as shown in Figures 1, 3, and 4.

30 In this operating position, in which the pushed-on unit is protected by a drive protective cover 24 held in place by means of a nut 26 screwed onto a threaded pin 25 against displacement in the direction opposite arrow A, or so protected by any other means, such as a locking pin or 35 by an automatically engaging spring, third gear 19 meshes with fourth gear 10, and second gear 21 meshes with first gear 11, so that the entire device is in an operating state as described above. In this state, therefore, the

bulk material loaded into bulk material container 12 in accordance with a control program of an electronic control device, which controls the dispensing device in a manner known of itself, can be dispensed at a desired dispensing rate. Following completion of a dispensing process, which can be terminated by the control device or by a manual switch, after loosening unit 26 on threaded pin 25, protective cover 24 can be removed and then the previously mounted unit can again be removed by displacement opposite the direction of arrow A and stored with a remainder of the bulk material contained therein. If the metering device is then required to dispense another product, another similarly designed unit, likewise structured as a bulk material container and dispensing device and provided with a cover if desired, is mounted in the manner described above, so that an operationally ready metering device is available once more. Since the cost of the bulk material container and the dispensing device are relatively low relative to the price of a complete metering device, and since the unit thus constructed, when not assembled to the base unit, can be used as a storage unit, in other words as a storage container for the bulk material, it is economically desirable to provide a special unit for each type of bulk material which is often processed. In this way one can be certain that the bulk material to be processed has not been contaminated by another bulk material. In the case of bulk materials that have good pouring properties and no tendency to clog, a unit without a mixer can of course be used, in other words a unit with a slightly simpler design.

Of course, differently designed means can be used not only for mounting the unit on the base but also instead of the means described with reference to Figures 8, 11 and 12 for correct positioning of the unit on the balance pan.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A metering device for metered dispensing of a bulk material, comprising:

5 a removable unit including a bulk material container and a dispensing device;

a drive for driving the dispensing device;

a balance; and

10 an electronic control device for controlling the metered dispensing,

wherein the removable unit is separable from the drive, balance and control device; and the drive, the balance and the electronic control device are not separated from the metering device upon removal of the removable unit.

15 2. The metering device according to claim 1, wherein the dispensing device comprises a screw conveyor with a non-rotatably mounted tube, said tube including a filling opening and a feed screw which is rotatably mounted in the tube, wherein the bulk material container terminates at the filling opening of the tube and the bulk material container is permanently attached to the tube.

20 25 3. The metering device according to claim 1, wherein the dispensing device includes a screw conveyor with a nonrotatably mounted tube, said tube including a filling opening and a feed screw which is rotatably mounted in the tube, wherein the bulk material container terminates at the filling opening of the tube and the bulk material container is permanently attached to a housing surrounding the tube.

30 35 4. The metering device according to claim 1, further comprising a first gear permanently attached to the drive and a second gear permanently attached to the dispensing device, said first and second gears meshing with another to transfer a drive energy from the drive to the dispensing device.

5. The metering device according to claim 2, further comprising a first gear permanently attached to the drive and a second gear permanently attached to the

dispensing device, said first and second gears meshing with another to transfer a drive energy from the drive to the dispensing device.

5       6. The metering device according to claim 3, further comprising a first gear permanently attached to the drive and a second gear permanently attached to the dispensing device, said first and second gears meshing with another to transfer a drive energy from the drive to the dispensing device.

10      7. The metering device according to claim 1, wherein the removable unit further comprises a mixer, said mixer including a third gear being nonrotatably connected to the mixer, said mixer being driven by a drive motor associated with the drive for the dispensing device, said drive motor including a fourth gear being nonrotatably connected to the drive motor and meshing with the third gear.

15      8. The metering device according to claim 2, wherein the removable unit further comprises a mixer, said mixer including a third gear being nonrotatably connected to the mixer, said mixer being driven by a drive motor associated with the drive for the dispensing device, said drive motor including a fourth gear being nonrotatably connected to a drive of the drive motor and meshing with the third gear.

20      9. The metering device according to claim 3, wherein the removable unit further comprises a mixer, said mixer including a third gear being nonrotatably connected to the mixer, said mixer being driven by a drive motor associated with the drive for the dispensing device, said drive motor including a fourth gear being nonrotatably connected to the drive motor and meshing with the third gear.

25      10. The metering device according to claim 4, wherein the removable unit further comprises a mixer, said mixer including a third gear being nonrotatably connected to the mixer, said mixer being driven by a drive motor associated with the drive for the dispensing device, said

drive motor including a fourth gear being nonrotatably connected to a drive of the drive motor and meshing with the third gear.

5        11. The metering device according to claim 5, wherein the removable unit further comprises a mixer, said mixer including a third gear being nonrotatably connected to the mixer, said mixer being driven by a drive motor associated with the drive for the dispensing device, said drive motor including a fourth gear being nonrotatably connected to the drive motor and meshing with the third gear.

10        12. The metering device according to claim 6, wherein the removable unit further comprises a mixer, said mixer including a third gear being nonrotatably connected to the mixer, said mixer being driven by a drive motor associated with the drive for the dispensing device, said drive motor including a fourth gear being nonrotatably connected to the drive motor and meshing with the third gear.

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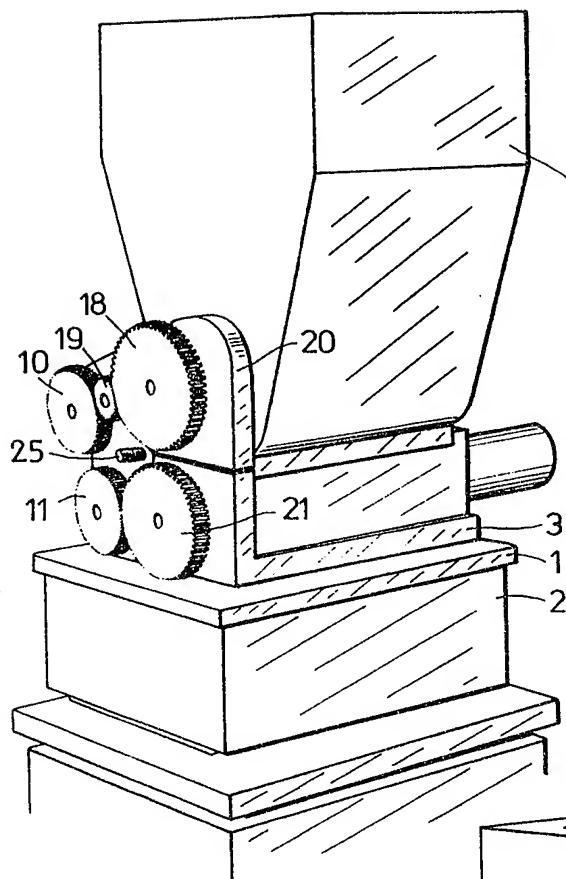
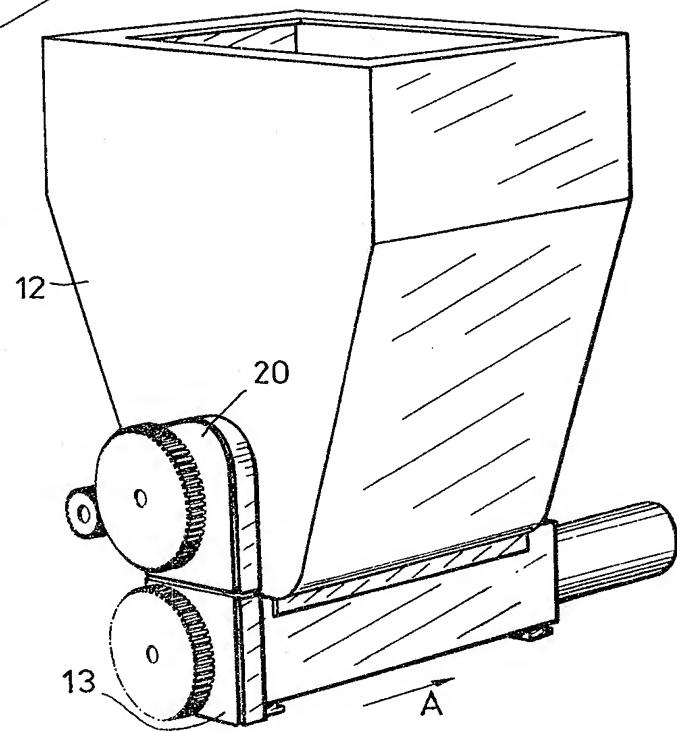


Fig.1



Fig. 2



PATENT AGENTS

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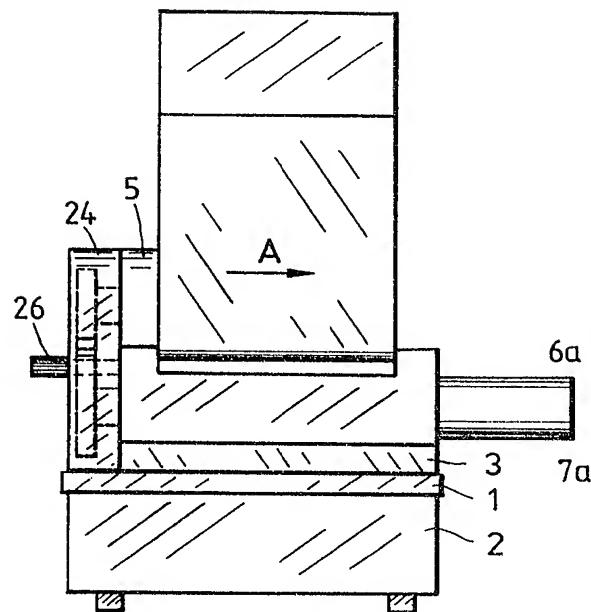


Fig. 3

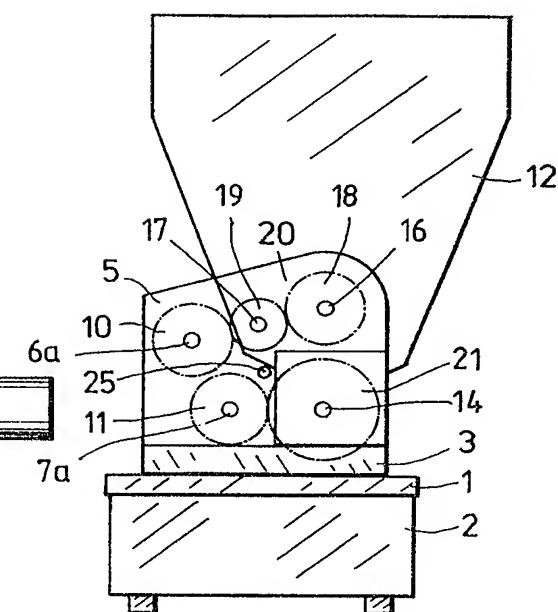


Fig. 4

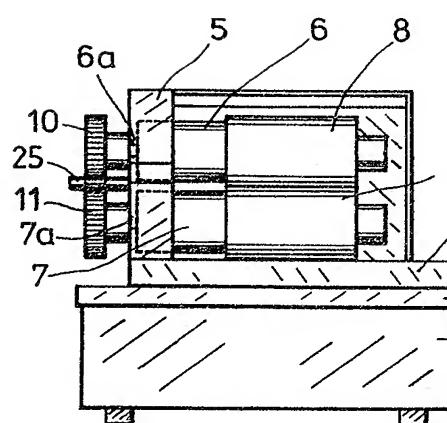


Fig. 5

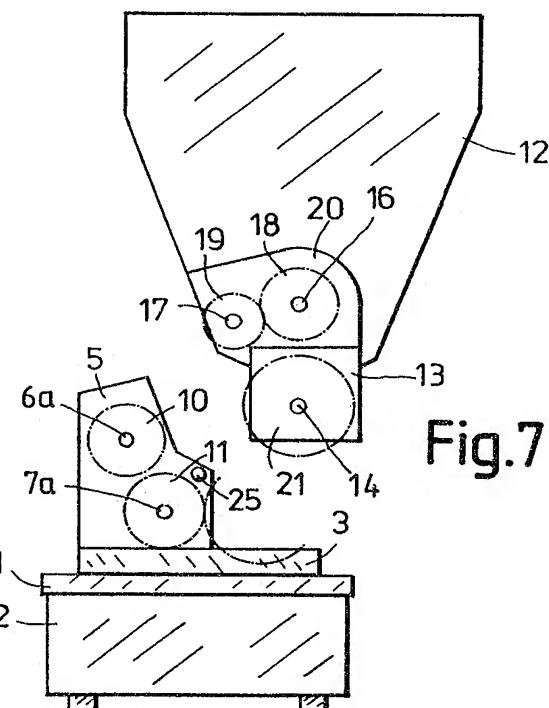


Fig. 6

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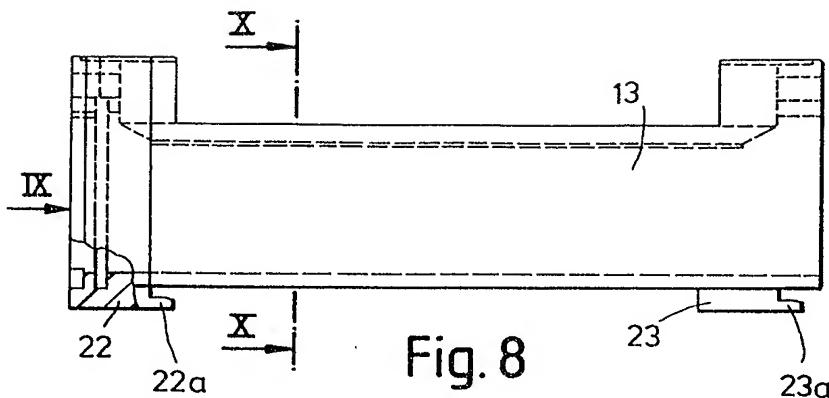


Fig. 8

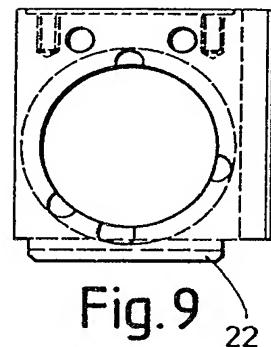


Fig. 9

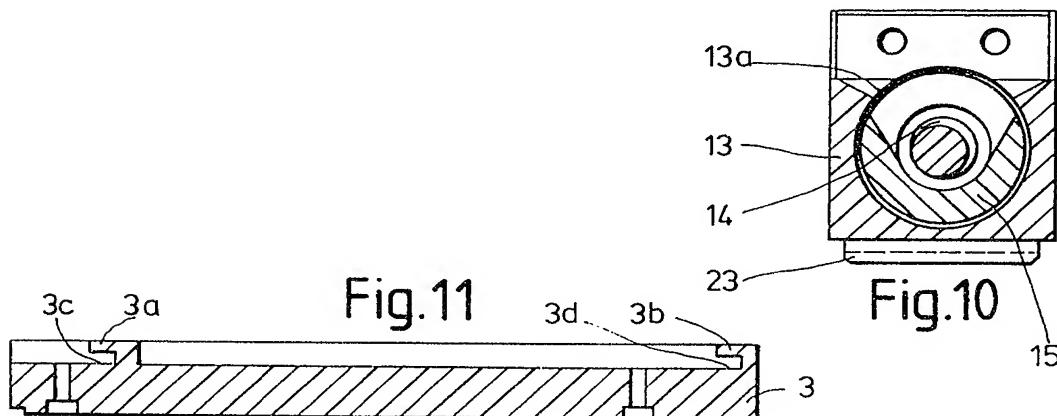


Fig. 11

Fig. 10

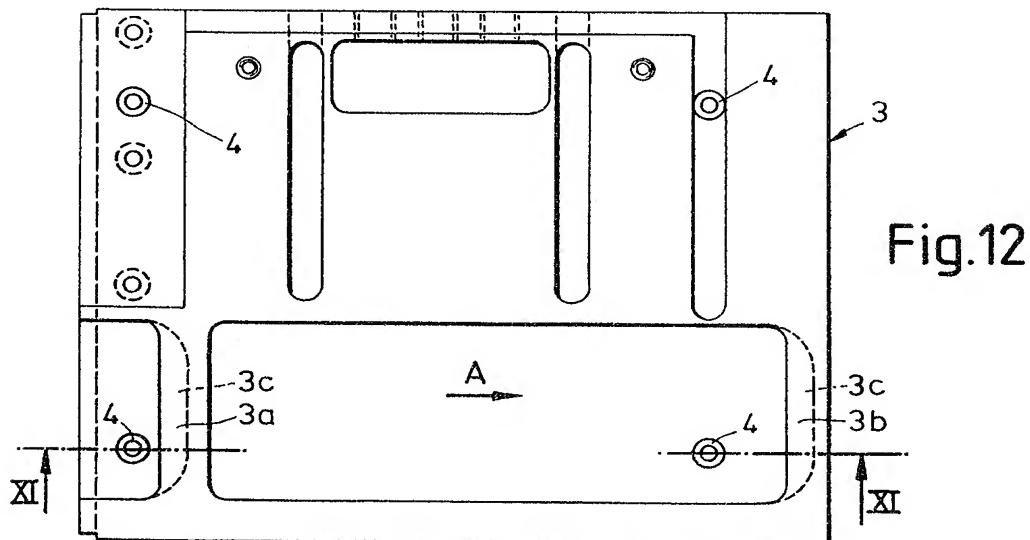


Fig. 12

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